

# **A Hydrologically-Consistent Multi-Satellite Climatology of Evaporation, Precipitation, and Water Vapor Transport Over the Oceans**

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## **Abstract**

Our objective is to use data from 10 microwave radiometers to estimate water vapor transport and evaporation over the oceans and then to derive precipitation estimates using the hydrological balance equation. The uncertainty in evaporation and water vapor transport will be used to estimate the uncertainty in the derived precipitation. Evaporation will be estimated using a bulk formula, and the use of a formula makes uncertainty analysis straightforward. Water vapor transport will be estimated in a new way by using feature tracking techniques with passive microwave water vapor imagery. On-orbit simulation experiments will be used to evaluate, improve, and estimate the uncertainty of the feature tracking technique. The successful use of feature tracking is possible because we will combine the water vapor data from 10 different microwave radiometers. Water storage is also a small term in the atmospheric hydrological budget, and is calculated as the time rate of change at a location.

The expected outcome of this work is (1) a set of 6-hour 0.25° water vapor maps objectively analyzed using all available passive microwave data, and (2) a set of monthly 1° climatological maps of evaporation, precipitation, zonal and meridional components of water vapor transport, water vapor transport divergence, and water vapor storage. The maps will cover the global oceans for the 11-year period 1998-2009. The monthly maps will also be accompanied by maps giving uncertainty estimates for each parameter. Thus, we will be producing a monthly dataset which is both hydrologically consistent and is accompanied by a complete uncertainty analysis.

The value of this work is in providing an independent comparison dataset for precipitation. Over 70% of the globe is covered by ocean, where very little *in situ* precipitation data are available. Our hydrological-balance estimates of precipitation will be free of the usual microphysical and beamfilling uncertainties such as: rain drop size distribution, the cloud to rain water ratio, hydrometeor phase, precipitation vertical profile, and horizontal inhomogeneity (beamfilling). As such, our work should shed light on these uncertainties in “traditional” precipitation estimates.

The proposed work has value because it (1) provides NASA Energy- and Water-cycle Study (NEWS) with a key accounting of reservoirs and fluxes associated with the global water cycle and (2) because it will provide increased understanding of closure accuracy assessments and error assessments. The datasets produced by the proposed work will contribute to answering the Earth Science Enterprise (ESE) question of how global precipitation, evaporation, and cycling of water are changing. The datasets produced will help provide a critical linkage between precipitation estimates and water cycle characterization along the NASA Water and Energy Cycle Roadmap. The precipitation estimates and uncertainty estimates will be highly relevant to the TRMM and GPM projects.